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Continuous innovation – combining Toyota Kata and TRIZ for sustained innovation

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Abstract

Companies are facing increasingly tough competition in the global economy. Previously sustainable competitive advantage strategies are insufficient in the changed market conditions. The only sustainable advantage is continuous innovation at a faster pace than rival organizations. This requires a systematic approach to innovation and engaging staff on all levels to effectively take part in the innovation efforts.

Toyota Kata is a proven and highly successful method for continuous improvement at the whole organization level. Toyota Kata was discovered by Mike Rother while he researched Toyota's quality improvement methods. It is a holistic system method for improvement efforts which contains processes and behavioral patterns for strategically aligned goal setting, problem solving, coaching, management and training. It is a simple and teachable approach which also covers the management of improvement efforts. The downside of the approach is its focus on incremental improvement instead of breakthrough innovation.

The approach can be improved by adding TRIZ techniques like contradiction analyses, FAA, inventive principles and trends of evolution to various parts of the method. This approach will allow to keep the benefits of the Toyota Kata approach while changing the focus from incremental improvement to true innovation. The combined approach is also better suited for the more complex problems of today's knowledge workers. Toyota Kata can also be used as method for introducing and training TRIZ to the organization in an effective and incremental way.

The combined method for continuous innovation can be further improved with the Lean Startup methods to validate the solutions. The Lean Startup experimentation approach is geared to design quick and inexpensive approaches for the market validations of service, management and software innovations.

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Keywords: Lean; Toyota Kata; TRIZ; Systematic Innovation; Lean startup.

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1. Introduction

Nomenclature

PDCA	The Deming cycle: plan, do, check, act
TRIZ	Theory of inventive problem solving
FAA	Function and attribute analyses

We live in a world with increasing pressure for improvement. There are many sources for that pressure, but perhaps the three most important once are:

1. In the global economy it is not enough to have competitive pricing and efficiency in your local area, but we increasingly have to be cost competitive against countries with significantly lower wages and cost structures.
2. Many product and service areas are increasingly under "winner takes all" market conditions, where it is not sufficient to be "pretty good", because consumers are buying the best product/services from the global markets and what is best is increasingly defined by intangible attributes.
3. We live on a planet that has limited resources, and we have to stop wasting those resources in the way we design and produce products and services.
4. For countries with high cost structures and standards of living, like the authors homeland Finland, this means that we have to continually innovate better products/services and betters means of producing them to be competitive and sustainable. Luckily the awareness of the situation is good, but unfortunately it is easier said than done. Despite considerable innovation investments (and some successes) the results have not been what we perhaps had hoped for.

To quote W. Edwards Deming "a goal without method is nonsense". So what we need is a method that is designed to handle the challenges we are facing. Luckily there are suitable (although underutilized) methods for the job at hand: innovation. Two methods that contain the potential (when used properly) to tackle current challenges are:

1. Lean continuous improvement methods like Toyota Kata can help engage everyone in the organization in innovation.
2. TRIZ techniques can help us systematically create significant innovations instead of minor improvements.

This article proposes a hybrid approach with Toyota Kata's focus on getting everyone involved and systematic coaching combined with TRIZ's ability to create breakthrough innovations. The author chose Toyota Kata and TRIZ as the starting points because , in the authors' view, they supplement each other well and therefore contain a lot of potential synergy. The choice was also made based on personal experience with these methods. The proposed continuous innovation method is in its early stages and the author hopes to collaborate with other people with similar interests to get feedback, improve the approach and gather data of its effectiveness.

2. Previous work

2.1. The DNA of high performance organizations

Toyota is a company that has been widely studied. This is mainly because of their above average industrial performance for the last 40 plus years. The initial focus of this research and benchmarking was on the specific tools Toyota uses both in its manufacturing operations and product development processes. Tools like Kanban, A3 documents, poka yoke and andon lines became known in western companies through publications like the Lean machine and the Toyota Way.

Many companies tried using these tools in their operations with some success, but often failed to achieve the kind of remarkable results in quality, speed and productivity that Toyota is known for [1].

As often is the case the truth lies beneath the surface and requires a bit more digging to be revealed. Steven J. Spear was the first researcher who managed to find the underlying core capabilities, which produced both the tools and the results that intrigued so many companies. He also discovered the existence of these core capabilities in other high performance organizations like Alcoa, aQuantive and the US Navy's nuclear power propulsion program [2].

Spear identified four distinct core capabilities:

1. System design is done by specifying the expected output, workflow and responsibilities and any gaps between what is expected and actual results are surfaced immediately.
2. Any problems are immediately contained, investigated and resolved using the scientific method (PDCA) to ensure that problem solving creates reusable knowledge for the organization.
3. Knowledge is effectively shared from the local level, where it was discovered, throughout the organization when needed. In addition to the solution the discovery process is shared as well.

Management is focused on developing these core capabilities for the area they are responsible for.

2.2. Toyota Kata

The research of Steven J. Spear acted as one of the impulses, which led to Mike Rother researching and codifying the details of how Toyota systematically improves their way of working and manages those improvement activities. Rother codified this knowledge in the Toyota Kata form so other organizations could adopt the core of Toyota's continuous improvement approach and apply it in their own organizations [1].

A Kata is a structured routine that is practiced deliberately to form new skills and supporting habits. Through many repetitions of the Kata it is possible to imprint the behavioral patterns to an extent that they become second nature. This is a widely used teaching method in Japan for example in martial arts. Current neuroscience research supports the idea that through repeated practice of a routine (Kata) we can rewire our brains to new ways of thinking and habits due to the plasticity of our brains [3].

The idea behind Toyota Kata is that it gives routines (Kata's) to practice that with time and repetitions will rewire our brains in a way that systematic improvement and managing will become second nature for us. When this is achieved on an organizational level it can allow the organization to adapt to changing circumstances faster and better than other organizations. The practice of Toyota Kata is done using real work related problems and challenges (that are increasingly difficult), which makes it economically viable to practice to the extent that Toyota Kata becomes second nature. It is in fact a core idea of Toyota Kata that everyone's work consists of two parts [1]:

1. The actual work
2. Improving the work

Routines are often associated with static behavior and seen as the opposite of change and adaptivity. The behavioral routines that Toyota Kata teaches are tailored for changing, improving and learning. So when we face new circumstances, or challenges, that put us beyond our comfort zone we can take refuge in the knowledge even though we do not know what solution will be we know the behavioral and thinking patterns (and are skilled in using them) that will allow us to discover the solutions. This allows us to effectively work with uncertainty in a way that does not burden us emotionally to the extent, where it becomes an obstacle for effective improvement [3].

Toyota Kata can be thought of as a four part system:

1. Vision
2. Challenge
3. The Improvement Kata
4. The Coaching Kata
5.

Two of those parts are related to understanding the direction of improvement activities (vision and challenge) and two are behavioral routines (Kata's) to improve and teach/coach/manage improvement.

The vision sets and communicates the organizations long term direction. It is often called "true north", because it only points at direction, but is usually too vague to act as a direct guide for current improvement activities. The vision is "permanent" and often can be paradoxical [3]. An example of a vision could be:

- Zero defects, 100 % value adding steps
- Single piece flow
- 100 % security for employees and lifelong employment
- Contribute to society by improving transportation for the whole global population

A challenge is typically set for a time span of 6 months to 3 years. It is aligned with the vision and gives more concrete guidance on where the organization's improvement efforts should be focused towards. A challenge can be described as "a non-negotiable stretch goal to better serving the customer". A challenge should not be easy to achieve, but neither should it be impossible. The route to achieve the challenge should be unclear [3]. An example of a challenge could be:

- Triple the number of customers who are extremely happy (5/5) about our services and cut service production costs by 10 % without layoffs by date X.

The Improvement Kata is routine to systematically and scientifically approach improving towards a target condition. The Improvement Kata is four step process that is divided into two phases (the planning and the execution phase) [3].

The steps of the Improvement Kata are [3]:

1. **Understand the direction (planning).** In this step the vision and challenge are used as guides to understand the direction in which the local improvement activities should be aimed toward.
2. **Grasp the current condition (planning).** The current condition of the focus of improvement is studied to form a deep understanding of the current situation based on facts and actual observations.
3. **Establish the next target condition (planning).** In this step the next target conditions is established. The deep understanding of the current situation is the basis for setting the target condition. The target condition should be just beyond the current knowledge threshold. In other words it should be challenging enough that it is not clear how it will be achieved. A target conditions time span can vary between one week and three months.
4. **Iterate toward the target condition (execution).** Because the target condition is outside the current threshold of knowledge it is not possible to simply form a plan and executed it. Instead the target condition is achieved by a routine of fast PDCA experimentation to discover the unclear route to the target condition.

Once the target condition is achieved the Improvement Kata starts over again. The idea is, that instead of doing occasional improvement projects, improving is always a part of daily work and never ends. The Improvement Kata is simple to get started with (and teachable because of that), but it is difficult to master and can be a life long journey of learning.

There are detailed, yet simple, routines for each of the process steps of the Improvement Kata which can be practiced until they become second nature. These routines are documented in reference [3].

The Coaching Kata is a way of teaching and coaching the improvement Kata and aligning the direction of the improvement activities to the common goals of the organization. The role of the coach and coaching kata is to help the person who is doing the Improvement Kata (learner) to stay within the Kata routine [3].

It is important to not deviate from the Improvement Kata routine until a high level of competence is achieved because this will harm the learning of the Improvement Kata mental model and lower the probability of achieving good results in the long term.

The person who is doing the Coaching Kata should under most circumstances be experienced and very fluent in the Improvement Kata routine. The coach is responsible for results, but he cannot give the answers to the learner. Instead he must focus on teaching the Improvement Kata so that the learner can discover the path for himself [1].

During the planning phase of the Kata the coaching routine is based on communicating the direction, teaching based on personal experience of the Improvement Kata and helping the learning to stay within the corridor of the Improvement Kata based on coaching. For the execution phase there is a simple routine of five questions that are repeatedly discussed (daily is the ideal) with the learner that will help him stay focused on learning the path to the next target condition through fast based PDCA experimentation[3].

It is natural that a personal approach to Toyota Kata is developed over time, but it is important to follow the Kata exactly until a sufficient level of competence is achieved. The eventual goal is that in that personal variation will slip into the background the behavioral and thinking models will become intuitive [3].

Toyota Kata has also many other benefits that where not discussed in detail in this article [1,3]:

- Counter acts cognitive biases
- Create alignment in the organization from the strategic level to the operational level
- Engage employees through common challenges and frequent successes towards it
- Common approach to improvement and management facilitates effective collaboration across the organization
- Fractal deployment allows the utilization of the organizations collective intelligence to continuous improvement activities

The methods for getting started with Toyota Kata are also well documented in references [1] and [3]. This makes getting started relatively easy, but of course does not relieve us of the need for sufficient quantities of deliberate practice.

2.3. Solving IT and business problems with TRIZ

TRIZ has a long tradition of techniques and methods that generate innovative solutions very effectively. There is a lot of literature and studies on the topic. The continuous innovation method that this paper introduces pulls its TRIZ techniques from two sources: Hands of systematic innovation for business and management [4] and Systematic (software) innovation [5]. Both of these books are authored by Darrell Mann and written with plenty of case examples, which makes them easy to approach.

The techniques introduced in these books are customized for business and IT domain problems, which is the field where the author mostly works.

Mann offers also a theoretical foundation for systematic innovation, which is composed of seven pillars [5]:

1. Perfection
2. Escape (psychological inertia)
3. Resources
4. Functionality
5. Emergence
6. Contradictions
7. Turtles (the recursive nature of systems and innovations)

The techniques are divided into two categories [4] 1) define and 2) solve. In practice many of the techniques are flexible enough that they can be used both to define the problem and to generate solutions (for example the system operator).

Table 1 offers a summary of the most relevant techniques for this article.

Table 1. Summary of relevant TRIZ techniques

TRIZ techniques with descriptions
40 inventive principles with examples [4,5]
The inventive principles offer patterns for designing innovative solutions to problems. They are based on the patent database and are documented with relevant examples to provoke ideas.
Conflict-contradiction conversion template [4,5]
The template offers a good visual representation for the problem as a problem statement, conflict and contradiction.
Conflict matrix [4,5]
The conflict matrix documents the most likely inventive principles to generate good solution for conflicts between different attributes.

Where to innovate [5]

A useful template to categorize innovations for an industry and discover good candidate areas for future innovation.

Function and attribute analyses [4,5]

FAA is proven technique to form an understanding of the current state of a system by mapping its elements and their interactions. FAA also helps to map both the positive and negative intangibles of a system.

Trends of evolution [4,5]

Systems evolve towards perfection through certain trends of evolution. By mapping a systems current state regarding these trends it is possible to discover areas where there is a lot of potential for improvement. Trends of evolution can also be used to generate solution ideas.

Resources [4,5]

By mapping the available resources in a system it is possible to generate solution ideas that rely on free and/or underutilized resources. Resources can also act as a trigger for solutions. Recourses can also be intangible like human cognitive biases.

Perception mapping [4,5]

Perception mapping is a good method for approaching complex problems by mapping the network that the individual perceptions form and identifying which perceptions hold key positions in that network and focus improvement efforts to those areas.

System operator [4]

The system operator, also known as the nine windows, method helps to look at the problem from different viewpoints regarding time (past, present, future) and abstraction level (system, micro system, macro system) It is very flexible and can be used to understand a problem, discover resources and generate solutions.

Stakeholder ideal final result definition [4]

This tool allows the mapping of what perfect looks for different stakeholder groups regarding different attributes of the system (like speed, cost, etc.). The results are documented in matrix where on dimension is formed by stakeholders and the other by system attributes. The matrix is useful for identifying contradictions.

2.4. Design with TrenDNA techniques

Darrel Mann and Yekta Özözer describe in their TrenDNA book [6] how to understand (and forecast) populations behavior and trends in a systematic way and how to put that knowledge into use in designing products and services. The theoretical basis for these techniques is built on two theories:

1. The spiral dynamics model explains human behavior by dividing thinking styles into eight categories with distinct ways of thinking and preferences. The model was originally based on research by Clare Graves.
2. The Generational cycle theory which divides the population based on date of birth and location into four different generational archetypes. Each archetypes has its own distinct nature, which changes according to age. The model is based on research by William Straus and Neil Howe.

Many of the techniques are very practical and relatively straight forward to use. The techniques are especially helpful for understanding the intangible needs of customer, which is increasingly important, because they are often the main driver for customer decisions as tangible needs are often met by multiple products.

The TrenDNA techniques can also forecast the changes in preferences of customers and potential discontinuous shifts in the intangible requirements at generational and thinking style boundaries.

Table 2 offers a summary of the most relevant techniques for this article.

Table 2. Summary of relevant TrenDNA techniques

TrendDNA techniques with descriptions
Thinking styles
By mapping the (potential) customers of a product/service it is possible to identify user segments with distinct likes and dislikes. This also a good way to discover contradictions between difference thinking style preferences for a product/service.
Generational mapping
By mapping the (potential) customers into the generational archetypes it is possible to gain insights into their intangible preferences. This type of mapping will also reveal potential shifts in preferences as the age boundaries of generations move due to aging.
Functional world
The functional world is a method of mapping the functions provided by product/service. It is a 2 by 2 matrix with one dimension being me/we and the other tangible/intangible. It is very useful for discovering the intangible functions of the product/service.
Contradiction resolving provocations
18 strategies or provocations that help create innovative solutions to resolve contradictions. They offer an interesting alternative for the 40 inventive principles for some situations (especially workshops).

2.5. Fast prototypes and solutions with Lean startup, Agile development and development platforms

The Lean startup method was first documented by Eric Ries. It offers a systematic and scientific approach to building startups which previously used to be considered an art. The basic idea in the Lean startup method is to document your assumptions about your business idea. Your assumptions include things like [7]:

- What problem are you solving
- Who is your customer
- Do they want your solution

Once you have documented your core assumptions about your business idea the next step is to go through a "build- measure-learn" loop. During the "build-measure-learn" loop you create the smallest thing possible that you can use to measure and validate your assumptions. If your assumption was correct you move on to validate the next assumption. If it was not correct you can use the data from the experiment to rethink your assumption and pivot your startup [7].

The Lean startup method is a large topic and has had a large impact on how startups operate worldwide. For the purpose of this paper the most relevant part about the method is the innovative techniques it contains to quickly and cheaply validate (or invalidate) complex ideas.

The Lean startup method contains several different kind of validation techniques for different kinds of ideas [8]:

- Product ideas can be validated by "smoke tests" where a mock website is created about the product. At a minimum the website can consist of a landing page with a product description and buy link. If the customer clicks the buy link than a message saying "unfortunately the product is not yet available" is displayed. This way the demand for the product can be validated without building it.
- Service ideas can be validated with a "concierge test" where a service that will be automatic when it is ready can be validate by performing the task with manual labor to validate the idea and the customers willingness to pay for the services.

- New features to existing products can be validated by putting links for the new feature in the application without actually implementing it. The features will display a message that it is not yet ready (but will be soon) and collect measurement data if enough users will use the feature.
- In some cases a "minimum viable product" (which is the smallest version of the product with any value for the customer) is developed quickly using web application frameworks and working methods that allow fast development. The impact of the minimum viable product is measured and decisions about investing in further development are based on that data.

Agile software development methods provide a fast and effective way of developing software compared to traditional development and are often used to create the software necessary for the Lean startup experiments.

Increasingly sophisticated product platforms are also available for developers. For example the Google Apps platform is a widely used productivity tool suite that contains high quality applications for text editing, spreadsheet calculation, presentations, online file sharing and web publishing [9]. The Google Apps platform also offers the possibility to develop new applications. These new applications can use the existing components and thus it is possible to develop complex application prototypes with only tens or hundreds of lines of code. This makes it viable to build prototypes for many different kinds on ideas because the cost and time to develop the prototype are small.

Many other large software vendors are also offering (or starting to offer) similar possibilities to use their existing solutions an application development platform.

3. The continuous innovation model

The author proposes forming a hybrid "continuous innovation" model by combining Toyota Kata with TRIZ techniques. The goal of the continuous innovation model is:

1. Offer an holistic and systematic way for an organization to pursue the organizational vision on all organizational levels with everyone participating
2. Although individual improvement and innovation activities are autonomous they are aligned towards the common vision and challenges.
3. Offer an effective and systematic way of teaching and coaching the method to get everyone in the organization sustainably engaged in participating in the improvement efforts.
4. Generate improvements which are creative, use resources effectively and offer significant benefits over previous solutions.
5. Allow rapid validation and implementation of new innovative ideas.

The proposed solution is to use the Toyota Kata improvement and coaching routines and add suitable TRIZ techniques to various parts of the Improvement Kata. The added TRIZ techniques are not only intended to be used in isolation, but also in a way that together with Toyota Kata they form a holistic system where the results of individual techniques act as inputs for other techniques in other parts of the Kata. The main potential benefits of adding TRIZ techniques to Toyota Kata are:

- Generating better and more innovative solutions by lessening the effects of psychological inertia and offering guidance to where good solutions can be most likely found.
- Having a systematic approach to deal with difficult aspects of Toyota Kata like understanding the current situation, forming the vision, identifying the right challenges the organization should strive towards.

Table 3 summarizes the way the author proposes TRIZ techniques can be added to Toyota Kata. It is only one possible solution and there is a lot of room for different approached due to the large amount and flexibility of TRIZ techniques available. A guiding principle for the author has been to try to evaluate not only how well an individual technique works, but how well it fits together with the other techniques. The idea has not been to map all possible techniques to Toyota Kata, but rather to give examples of how that mapping can be done.

The proposed solution is also influenced by the type of problems the author is involved with (business and IT). The author would very much like see other mappings proposed (to the same or different problem domains).

The proposed continuous innovation model is not intended to be taught and implemented at once. The idea is to start with the classic Toyota Kata model and a few simple TRIZ techniques and expand to utilize of more TRIZ techniques over time as the organization becomes more fluent with the basic approach.

Table 3. Mapping TRIZ techniques to Toyota Kata phases

Toyota Kata	TRIZ techniques
Establish the vision ("permanent")	stakeholder ideal final result definition, functional world
Establish the challenge (0,5 – 3 years)	Conflict-contradiction conversion template, where to innovate, functional world, trends of evolution, thinking styles, generational mapping, perception mapping
Grasp current condition	System operator, function and attribute analyses, perception mapping, resources
Establish the next target condition (1 week – 3 months)	Conflict-contradiction conversion template, describe changes to FAA model or perception map
Find path to target condition (daily)	System operator, 40 inventive principles, conflict matrix, contradiction resolving provocations

3.1. Establish the vision

The Toyota Kata concept of a clear vision to strive towards is very appealing and powerful. Unfortunately, at least in the author's experience, writing such a vision can be a daunting task. Mapping the functional world of the organization can be a good starting point. By discovering what functions (both tangible and intangible) the organization is fulfilling it is easier to see beyond today's products and services. Understanding the intangible functions is especially important in today's landscape where tangible functions are often well served. By focusing on the functions it is possible to write a vision that is valid because although products and services have increasingly shorter lifespans functions are relatively stable.

Even after understanding the functions, establishing what perfection (the vision) is can be difficult. Simple TRIZ questions like "what if it did it by itself?" or "how can we have all the benefits without any of the harms/costs" can be helpful.

Stakeholder ideal final result definition offers a powerful approach to discovering the vision. By identifying the most important stakeholders and attributes we can formulate a vision matrix that describes the often confliction desires of different stakeholders. By formulating the vision this way the conflicts and contradictions become clear for everyone and the organization can start the process of innovating towards the vision in way that resolve those conflicts.

The vision matrix is a good alternative to a vision statement that formulates a compromise between the different needs, because it is much harder to drive innovation and create engagement with a vision that is "rounded" almost to the point where it ceases to be meaningful.

3.2. Establish the challenge

A good challenge has three requirements:

1. It must be aligned with the organizations vision
2. At that time it must be the most important thing for the organization to focus its improvement efforts on.
3. It must be formulated in a clear and engaging way Formulating such a challenge is not an easy task, but TRIZ offers many helpful techniques.

If the vision is formulated as a vision matrix (stakeholder ideal final result definition) it will likely contain conflicts/contradictions. Those contradictions are good candidates for challenges. The contradictions can be visualized using the conflict-contradiction conversion template to create clarity and engagement.

Especially for consumer focused organizations the TrenDNA techniques can be used to understand the changing needs of customers. Based on thinking style analyses and generational mapping it is possible to understand which areas the improvement activities should be focused on and formulate the challenge based on this understanding. This is especially true for intangible needs. TrenDNA techniques can also be used to predict discontinuous shifts in preferences. These can happen for example when a service (e.g. driving instructions) is focused on a certain age group and there is a generational boundary close to the target age. Companies that rely on traditional market analyses methods will likely not predict the discontinuous shift in time.

Often the problem when formulating a challenge is to (correctly) choose the most important aspect to focus on from many different alternatives. Perception mapping is a good tool for understanding the relationships between different alternatives and prioritize based on those relationships. The where to innovate tool can also give guidance about which areas of the industry are crowded with innovation and which areas offer "white space" for new innovations.

3.3. Grasp the current condition

A deep understanding of the current condition before starting the improvement efforts is a key idea in the Improvement Kata. However creating that understanding (and not jumping to conclusions) is difficult in practice.

The system operator technique can be very helpful in fighting our natural instinct to only look at the situation from a "here and now" perspective. It offers a systematic way of analyzing the situation from different time and system level perspectives. By understanding the current situation from a wider perspective it is possible design very creative ways for improving the system. The system operator can be also combined with resource identification which critical ground work for creating solutions that don't solve problems by simply adding new elements to a system. When doing resource analyses it is important to discover the intangible resources as well (like cognitive biases) in order to create innovative solutions.

Functional & attribute analyses offers a systematic way for deeply understanding the current situation by mapping all the elements of the system and their interactions (both tangible and intangible). The creating of a good FAA model is hard work, but by keeping it up to date as the system evolves creates a good foundation for Improvement Kata cycles. The FAA model can even stimulate potential improvement solutions just by clearly visualizing the current condition.

When the current situation seems to be very "fuzzy" and it is difficult get a grasp on the essence of it perception mapping can be a useful tool. It is especially useful with complex situations with a lot of human intangible elements.

3.4. Establish the next target condition

When FAA and/or perception map models where generated (or updated) during "grasp the current condition phase" the next target condition can be described as a changed version of that model. If for example an interaction between elements was discovered to be insufficient during function & attribute analyses the next target condition can simply be described by an updated version of the model where that interaction is sufficient.

If the chosen improvement target is a conflict or contradiction it can be documented with the conflict-contradiction conversion template.

3.5. Find the path to the target condition

The essence of this part of the Improvement Kata is to identify the obstacles between the current condition and the next target condition and find ways past those obstacles one at a time until next target condition is achieved.

The system operator technique can be a simple, but effective, way of finding creative solutions to the obstacles. Systematically trying to identify solutions from different time and system viewpoint will generate creative solutions that would probably not have been discovered by the traditional Improvement Kata approach.

The obstacles are very often conflicts or contradictions between different attributes of the system (like output quantity and quality). By using the 40 inventive principles it is possible to generate a large quantity of high quality and creative ideas to solve the conflict/contradiction. The 40 inventive principles allow the solver to draw ideas from the collective wisdom of the best solutions in the patent database. While using all 40 principles can lead to very strong solutions it also requires a lot of work. The conflict matrix offers a shortcut to this problem. By using the conflict matrix it is possible to identify the inventive principles that are most likely to produce good solutions to the conflict at hand and focus the problem solving efforts on generating ideas based only on those principles.

The contradiction resolving provocations offer an alternative method for generating creative ideas for solving conflicts and contradictions. It is perhaps easier for novice level solvers to get started with the contradiction resolving provocations and later move on to the 40 inventive principles and conflict matrix.

The Improvement Kata has a strong focus on experimental validation and learning during this phase. Risk of generating more creative and inventive solutions using TRIZ techniques is that it becomes harder to create quick experiments and stay within the fast PDCA cycle approach. Fortunately creating quick (and cheap) experiments for complex business and IT problems has become possible in many situations by:

1. Utilizing Lean startup techniques that can validate possible solutions without actually building them by using smoke and concierge tests.
2. Building quick (and cheap) prototypes by using high abstraction software platforms that have a large number of ready to use components combined with fast agile software development practices.

3.6. Teaching and implementing the continuous innovation model

One of the strong suites of Toyota Kata is that it offers an existing pattern to teaching, coaching and managing the Improvement Kata – the Coaching Kata. There is no need to reinvent the wheel in this regard, so the only relevant question is how to integrate the teaching and coaching of the TRIZ techniques.

An incremental approach starting with simple techniques and adding more as the need arises and the learner becomes more skilled in the basics seems like the best approach. The system operator, conflict-contradiction conversion template and contradiction resolving provocations are good starting points because they are relatively simple to teach, flexible in their use and teach basic TRIZ concepts like contradictions and looking at the problem from different viewpoints.

When the approach is implemented at a larger scale, then on single team, a good vision and challenge become key concepts. Utilizing the TRIZ techniques for these steps does require some experience. Using an experienced TRIZ practitioner to bootstrap the organization will likely be a good choice.

The availability of good coaches is often the bottleneck for scaling classic Toyota Kata and adding TRIZ techniques will likely highlight this issue. Because the continuous innovation model is in its early stages a lot of work and experimentation still needs to be done regarding the best ways of building the required competences.

3.7. Experiences using the continuous innovation model

The model is still in its early stages, so experiences and data are very limited so far. The author is a relative new comer to the TRIZ with only 18 months of experience and study. At first I used TRIZ techniques separately from the Improvement Kata. As I gained experience and realized the value of the TRIZ techniques I started to use TRIZ techniques together with the Improvement Kata routine. The usage of the techniques was not done in a systematic way in the beginning, but rather on an ad hoc bases when situation seemed to require additional help. The first techniques that were used were the system operator, conflict matrix and inventive principles. The initial experiences were very encouraging and my experience was that I was able to create a large number of possible solutions to choose from and many of them were more creative than usually.

After this I begun to use TRIZ techniques in coaching as well, but the scope of techniques was limited. The initial experiences were encouraging, although the amount of coaching needed was not insignificant.

As I made a career path change to a consulting role from a line management position about half a year ago I began to use increasingly more TRIZ techniques and started reflecting more systematically on how Toyota Kata and TRIZ could be combined into a holistic approach. My initial thoughts and personal experiences on the subject are documented in this article, but as more experience is gained the approach is likely to develop and mature. I'm currently looking for a client organization that would be a good fit to experiment together on the continuous innovation model at a larger scale.

3.8. Initial thoughts about the pros and cons of the model

The addition of TRIZ techniques has three main positive effects:

1. A larger number of more creative ideas to solve problems
2. A systematic approach to extending the improvement efforts to the intangible aspects, that are increasingly important in many industries today.
3. A systematic approach to many of the difficult parts of Toyota Kata, like understanding the current situation and choosing the right challenge

The approach does however add more complexity compared to the traditional Toyota Kata model. This creates pressure on the coaches to be very competent in teaching the method to make it accessible for everyone in the organization. The incremental approach to adding TRIZ techniques will help with this to some extent. A barrier for the adaptation of traditional Toyota Kata in many organizations is the amount of work to create a sustainable level of competence and supporting culture. This barrier will be even more highlighted in the continuous innovation model.

While more creative and inventive ideas are mostly a good thing, they do create pressure for organizations to create high level competencies in Lean startup techniques to be able to maintain an experimental validation and learning approach.

Some of the techniques (especially TrenDNA) do not necessarily fit well into existing ways of thinking in some organizations, which can create a barrier for adaptation.

4. Future work

The author intends to publish a follow up article with results from implementations of the continuous innovation model and is open to collaboration with regards to developing the method, experimenting with teaching/implementation models and collecting results from using the method.

The ideal case study would be finding an organization which would be open to implementing side by side the traditional Toyota Kata and the continuous innovation model and comparing the results. The focus of the follow up study would be to assess the quality and level of innovation of the generated solutions and their business benefits compared to a standard Toyota Kata approach. The study method will be a combination of surveys and expert reviews.

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